

natural world as a mechanism and all events in it as the result of the operation of a mechanism. In so doing he denied any ontological difference between natural phenomena and the workings of human made mechanisms:

I do not recognize any difference between artifacts and natural bodies except that the operations of artifacts are for the most part performed by mechanisms which are large enough to be easily perceivable by the senses – as indeed must be the case if they are to be capable of being manufactured by human beings. The effects produced by nature, by contrast, almost always depend on structures which are so minute that they completely elude our senses. (Descartes, *Principia* IV, section 203)

Descartes' conception of mechanism extended as well to the biological world, including the functioning of human bodies. In this he appealed frequently to metaphors with human-made machines, using them to suggest explanations of features of biological systems that initially appear to set them apart. For example, to explain the ability of animals to initiate motion, he appealed to such artifacts as clocks and mills that succeeded in moving on their own. Although William Harvey had already offered his own mechanical pump model for the circulation of blood, Descartes proposed to explain circulation as resulting from heating that caused the expansion of droplets of blood, which then forced their way through the arteries. He further appealed to the hydraulically moved statuary in the Royal Gardens to provide a model of the ability of the nervous system to transmit sensory and motor signals from the brain. He proposed that in animals the brain directed activity by altering the flow of very fine matter, the animal spirits, through the nerves (see Figure 2.1).

A generation after Descartes, the British chemist Robert Boyle (1627–91) coined the term *mechanical philosophy*. Boyle directed part of his empirical work to developing the air pump as a device for creating vacuums. In allowing for a vacuum, that is, space unoccupied by objects, Boyle developed a different perspective on a mechanistic conception of nature than Descartes had endorsed. Furthermore, his interest in the air pump was not just that of an engineer: Boyle sought to explain the ability of air to exert pressure, and proposed a mechanical model of air molecules as small springs that could be compressed and later expand. As exemplified in his account of air, Boyle's general strategy was to appeal to the shape and motion of hypothetical small particles to explain the properties of different chemical substances.

Although the notion of mechanism was a major feature of early modern philosophy, another tradition developed in the same period ultimately superseded it in philosophical accounts of science. Instead of explaining the